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DONALD R. HUFFMAN

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EXAMINER

CHANEY, CAROL DIANE

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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 08/471,890	Applicant(s) HUFFMAN ET AL.	
	Examiner CAROL D. CHANEY	Art Unit 1794	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 07 September 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 89-93 and 95-121 is/are pending in the application.
4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 89,91,120 and 121 is/are allowed.
- 6) ☒ Claim(s) 92,98,104,105,107,109,113,116,117 and 119 is/are rejected.
- 7) ☒ Claim(s) 90,93,95-97,99-103,106,108,110-112,114,115 and 118 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Declarations Pursuant to 37 CFR 1.132

1. This Office Action is responsive to the Declarations from Drs. Kroto, Terrones, and Darwish submitted under 37 CFR 1.132 on 7 September 2007. These declarations provide persuasive evidence that the instant application complies with the requirements of 35 U.S.C. 112, first paragraph regarding the term “macroscopic amount” in the instant claims. Although the original disclosure of the instant application does not provide ipsis verbis support for the term “macroscopic amount,” the Terrones Declaration (reproducing the process of making the product) and the Darwish Declaration (purification of the product) clearly show production and extraction of a macroscopic amount of C₆₀ and C₇₀, which are representative of fullerenes, following the same procedures described in the instant specification, specifically in Examples 1 and 2. These declarations provide evidence that the procedures described in the instant application inherently produce macroscopic amount of C₆₀ and C₇₀ and enable one of ordinary skill in the art to do so without undue experimentation.

Response to Amendment

2. Claims 89-93 and 95-121 are currently pending in this application. Claims 89, 91, 120, and 121 are allowed. Claims 90, 93, 95-97, 99-103, 106, 108, 110-112, 114, 115 and 118 are objected to. Claims 92, 98, 104, 105, 107, 109, 113, 116, 117 and 119 are rejected for reasons given below.

Terminal Disclaimer

3. The terminal disclaimer filed on 22 February 2005 disclaiming the terminal portion of any patent granted on this application which would extend beyond the expiration date of any patent granted on Application Serial No. 07/580,246 has been reviewed and is accepted. The terminal disclaimer has been recorded.

Duplicate Claim Objections

4. Applicant uses several terms in the claims that appear to be equivalent at the time of filing of the instant application. At the time of filing, the term "fullerene" was understood to mean the family of hollow caged carbon molecules with an even number of carbon atoms represented by C_{60} , C_{70} , etc. as stated by Harold Kroto in his declaration filed on 16 November 1999 in the instant application. At the time of filing, the terms "a cage carbon allotrope consisting solely of carbon atoms soluble in non-polar organic solvents", "a cage carbon allotrope consisting solely of carbon atoms soluble in non-polar organic solvents, which allotrope of carbon is neither graphite nor diamond", "allotrope of carbon consisting solely of carbon atoms, and soluble in non-polar solvents, which allotrope of carbon is neither graphite nor diamond", and "a cage carbon allotrope consisting solely of carbon atoms" can only refer to the carbon allotrope represented by the fullerene family since the only other known carbon allotropes at the time of filing are diamond and graphite.

Therefore, based on the definition of fullerene at the time of filing of the instant application and what was understood by one of ordinary skill in the art at the time of filing

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regarding carbon allotropes, the terms "fullerene", "a cage carbon allotrope consisting solely of carbon atoms soluble in non-polar organic solvents", "a cage carbon allotrope consisting solely of carbon atoms soluble in non-polar organic solvents, which allotrope of carbon is neither graphite nor diamond", "allotrope of carbon consisting solely of carbon atoms, and soluble in non-polar solvents, which allotrope of carbon is neither graphite nor diamond", and "a cage carbon allotrope consisting solely of carbon atoms" are equivalent.

Applicant apparently agrees that these terms for fullerene are synonymous. Based on applicant's remarks filed on May 9, 2006 in instant application 08/471,890, applicant equates the term "fullerene" with the terms "a cage carbon allotrope consisting solely of carbon atoms soluble in non-polar organic solvents", "a cage carbon allotrope consisting solely of carbon atoms soluble in non-polar organic solvents, which allotrope of carbon is neither graphite nor diamond", "allotrope of carbon consisting solely of carbon atoms, and soluble in non-polar solvents, which allotrope of carbon is neither graphite nor diamond", and "a cage carbon allotrope consisting solely of carbon atoms". Specifically, applicant states the following on page 10 of the remarks:

"For example, the application provides ample support for fullerenes...and for the term a carbon alleotrope consisting solely of carbon atoms, which is soluble in organic solvent... The application refers to "new form of carbon", (Page 1, Line 6), which defines a form of carbon other than diamond or graphite. It also describes an allotrope of carbon (e.g., see original Claim 27, and Page 16, Line 26 of the instant application), compounds made solely of carbon atoms soluble in non-polar organic solvents (see, e.g., Page 11, Lines 8-11 of the instant specification) and they form a carbon cage (see, for example, Page 11, Lines 9 and 20 in the instant specification). **All of these are descriptions and characterizations of and are synonymous with fullerenes. The whole thrust of the application is directed to a new form of carbon. In fact, the application is so titled. All of these delineations are different descriptions of and connote only one subject matter to one of ordinary skill in**

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the art, viz., fullerenes. Further as shown hereinabove, the language in the specification supports "a cage carbon allotrope consisting solely of carbon atoms soluble in non-polar organic solvents", as recited in the added claims." [emphasis and underline added]

In applicant's remarks filed on January 6, 2003 in instant application 08/471,890, applicant also states on page 5:

"..., the application provides ample support for fullerenes. Support thereof permeates the specification. More specifically, the specification describes three species C_{60} , C_{70} and C_{240} . Each of these molecules is a fullerene. C_{60} is fullerene-60, C_{70} is fullerene-70 and C_{240} is fullerene-240. The application refers to "new form of carbon", (Page 1, Line 6), which defines a form of carbon other than diamond or graphite. It also describes an allotrope of carbon (e.g., see original Claim 27, and Page 16, Line 26 of the instant application), compounds made solely of carbon atoms soluble in non-polar organic solvents (see, e.g., Page 11, Lines 8-11 of the instant specification). All of these are descriptions and characterizations of and are synonymous with fullerenes. The whole thrust of the application is directed to a new form of carbon. In fact, the application is so titled. All of these delineations are different descriptions of and connote only one subject matter to one of ordinary skill in the art, viz., fullerenes."

Likewise, the term "macroscopic" and "visible" when referring to the amount of fullerene produced are considered equivalent in light of the ordinary meaning of the term "macroscopic".

The ordinary meaning of "macroscopic" describes objects that are visible to the naked eye.

According to Hackh's Chemical Dictionary, 400 (4th ed. 1969) (copy attached), the term

"macroscopic" is defined as, "Describing objects visible to the naked eye. Cf. *microscopic*."

Similarly, The American Heritage Dictionary of the English Language, 781 (William Morris ed., New College ed. 1976) (copy attached), defines "macroscopic" as:

1. Large enough to be perceived or examined without instrumentation, especially as by the unaided eye.
2. Pertaining to observations made without magnifying instruments, especially as by the unaided eye.

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Furthermore, based upon applicant's remarks in instant application 08/471,890, the terms “macroscopic amounts”, “solid”, “solid form”, “colored solid” , “amounts sufficient to be capable of providing a visibly colored solution when extracted with benzene”, “visible product” and “visible solid” are considered equivalent when referring to the amount of fullerene produced.

In the same remarks filed on May 9, 2006 in instant application 08/471,890 referenced above, applicant states the following on page 19:

“Thus, a competitor of the present inventors had correlated the colored solution of benzene containing the fullerenes, e.g., the C₆₀, product with ‘visible amounts’, i.e., macroscopic amounts of same.”

From this statement on page 19, applicant is equating “macroscopic amounts” to “a colored benzene solution” and to “visible amounts.”

In the same remarks filed on May 9, 2006 in the instant application 08/471,890, applicant states the following on page 22:

“In addition, attention is directed to Example 1 of the instant specification wherein it is specified that a C₆₀ product, which is an example of fullerene is obtained as a powder and wherein the color of the product produced therefrom is indicated. Obviously, the isolation of a product as a powder taken together with the fact that it is a colored powder connotes that the product could be seen with the naked eye, consistent with the use of the term “macroscopic amounts”, as recited in the claims. As shown herein below, Dr. Kroto testifies that this fact evidences that the instant application reasonably conveys to one of ordinary skill in the art that the inventors had possession of a process of making macroscopic amounts of fullerenes. See Kroto Declaration, dated Nov. 16, 1999, Paragraph 15.”

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From this statement on page 22, applicant is equating "macroscopic amounts" to a "colored solid."

Furthermore, in applicant's remarks filed on May 9, 2006 in instant application 08/471,890, applicant states the following on page 33:

"Moreover, applicants respectfully submit that the Kroto, et al. article is non-enabling to make fullerenes, e.g., C₆₀ or C₇₀ in amounts that are visible or language equivalent thereto, e.g., visible solid form, in an amount sufficient to isolate as a solid, in macroscopic amounts or in any equivalent language. They never prepared solid or crystalline C₆₀ or C₇₀, as presently claimed. It was not possible to prepare the visible solid or, for that matter, C₆₀ or C₇₀, in any appreciable amounts, without undue experimentation."

From these statements on page 33 in the remarks filed on May 9, 2006 in the instant application, applicant admits that the terms "visible", "in an amount sufficient to isolate as a solid", "visible solid form", and "in macroscopic amounts" are equivalent language when referring to the amount of C₆₀ produced.

In applicant's statements filed on December 6, 1996 in instant application 08/471,890, applicant states on pages 12-13:

"There is adequate support in the application for the term "macroscopic"... For example, attention is directed to Page 7, Lines 10-25, Page 8, Lines 3-16 and to Example 1 of the instant specification wherein the color of the product produced therefrom is indicated. Obviously, one cannot determine color unless it is present in amounts that can be seen with the naked eye, i.e., macroscopic amounts. If less than macroscopic amounts were produced, no color would be seen even if the samples were dissolved in benzene. See, Curl, et al, Scientific American 1991, 54-55. Furthermore, attention is directed to Figure 2, of the instant specification wherein an X-ray diffraction pattern is provided of a product produced in accordance with the present invention. As the skilled artisan is well aware, macroscopic quantities had to be available to generate a X-ray diffraction of the product...Furthermore,

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the application describes that the product produced by sublimation of the carbon soot can range from a uniform film to a coating, and the color is brown to gray depending on the thickness of the coat formed, while the product obtained from extraction is a dark brown to black crystalline material. Obviously, these characteristics can be differentiated if the product was produced in amounts that can be seen with the human eye.”

From these statements on pages 12-13, applicant equates the term “macroscopic” with “colored solid”, “amounts sufficient to be capable of providing a visibly colored solution when extracted with benzene”, and “visible solid” when referring to the amount of fullerene produced.

The terms “extracting”, “isolating”, and “separating” as used in the claims appear to be equivalent since these terms connote some degree of purification. The term “recovering” as used in the claims is interpreted to be broader than the terms “extracting”, “separating”, and “isolating” and is interpreted as not requiring any degree of separation but only requiring simple possession of the substance.

Therefore, the following claims are objected to as being duplicate claims:

Claims 90, 93, 97, 108, and 110 are objected to under 37 CFR 1.75 as being a substantial duplicate of claim 89. When two claims in an application are duplicates or else are so close in content that they both cover the same thing, despite a slight difference in wording, it is proper after allowing one claim to object to the other as being a substantial duplicate of the allowed claim. See MPEP § 706.03(k).

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Claims 98, 99, 101-103, 106, and 111 are objected to under 37 CFR 1.75 as being a substantial duplicate of claim 91. When two claims in an application are duplicates or else are so close in content that they both cover the same thing, despite a slight difference in wording, it is proper after allowing one claim to object to the other as being a substantial duplicate of the allowed claim. See MPEP § 706.03(k).

Claims 112, and 114-118 are objected to under 37 CFR 1.75 as being a substantial duplicate of claim 121. When two claims in an application are duplicates or else are so close in content that they both cover the same thing, despite a slight difference in wording, it is proper after allowing one claim to object to the other as being a substantial duplicate of the allowed claim. See MPEP § 706.03(k).

Applicant is advised that should claim 104 be found allowable, claims 107, 109, 113 and 119 will be objected to under 37 CFR 1.75 as being a substantial duplicate thereof. When two claims in an application are duplicates or else are so close in content that they both cover the same thing, despite a slight difference in wording, it is proper after allowing one claim to object to the other as being a substantial duplicate of the allowed claim. See MPEP § 706.03(k).

Applicant is advised that should claim 92 be found allowable, claim 105 will be objected to under 37 CFR 1.75 as being a substantial duplicate thereof. When two claims in an application are duplicates or else are so close in content that they both cover the same thing,

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despite a slight difference in wording, it is proper after allowing one claim to object to the other as being a substantial duplicate of the allowed claim. See MPEP § 706.03(k).

The product-by-process limitation of claims 90, 92, 93, 97-99, 101-103, 106, 108, 110, 111, 112, and 115-118 are not given patentable weight since the courts have held that patentability is based on a product itself, even if the prior art product is made by a different process (see In re Thorpe, 227 USPQ 964, (CAFC 1985), In re Brown, 173 USPQ 685 (CCPA 1972), and In re Marosi, 218 USPQ 289, 292-293 (CAFC 1983)).

Additional Claim Objections

5. Claims 93, and 108-119 are objected to because of the following informalities: The term “alleotrope” should be “allotrope”. Appropriate correction is required.

6. Claim 114 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form.

Claim 114 is dependent upon claim 112. Claim 112 requires a cage carbon allotrope that is soluble in non-polar organic solvents (a fullerene) to be present in crystalline form. Claim 114 recites the identical limitation, and thus does not further limit claim 112.

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Claim Rejections - 35 USC § 112

7. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

8. Claims 98, 116 and 117 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 98 recites the limitation “said visible solvent”. There is insufficient antecedent basis for this limitation in the claim. It is also unclear what is meant by a visible solvent.

Claims 116 and 117 each depend upon themselves, and thus indefinite since a claim cannot depend on itself. The Examiner is interpreting claim 116 to be dependent upon independent claim 115 and claim 117 to depend from claim 116.

Claim 116 recites the limitation "the situs of vaporization". There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 101

9. 35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

10. Claims 92, 104, 105, 107, 109, 113, and 119 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter.

Claims 92, 104, 105, 107, 109, 113, and 119 are rejected under 35 U.S.C. 101 because the invention as claimed reads on coal deposits containing macroscopic amounts of C₆₀ and C₇₀

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(two species that are representative of fullerenes) found in nature as evidenced by Fang et al., “Evidence for fullerene in a coal of Yunnan, Southwestern China”, Mat. Res. Innovat. (1997), pp. 130-132 and Osawa et al., “Survey of Natural Fullerenes in Southwestern China”, pp. 421-424 in Nanonetwork Materials, edited by S. Saito et al., 2001, American Institute of Physics.

Fang et al. discloses that C_{60} and C_{70} (two species representative of fullerenes) are found in macroscopic amounts in coal specimens from China (see Table 1). Table 1 shows 17 mg of fullerene collected from coal specimen K with C_{60} present at a concentration of 74% and C_{70} present at a concentration of 24%. The concentration of fullerene in the coal specimen K was 2.6×10^{-4} (260 ppm). Table 1 also shows 4 mg of fullerene collected from coal specimen B with C_{60} present at a concentration of 85% and C_{70} present at a concentration of 15%.

Osawa et al. also found an unusually high concentration of C_{60}/C_{70} in a coal sample from the same coal mine in China (see abstract). Osawa et al. found 30 ppm of C_{60}/C_{70} in the coal sample by HPLC analysis (p. 421). The contents of C_{60}/C_{70} are considerably lower than reported by Fang et al. (Fang et al., “Evidence for fullerene in a coal of Yunnan, Southwestern China”, Mat. Res. Innovat. (1997), pp. 130-132), but still several orders of magnitude higher than the previously reported levels of other natural fullerenes (order of sub-ppm) and sufficient to indicate macroscopic amounts of C_{60}/C_{70} in the coal mine.

Furthermore, in the remarks filed by applicant on May 9, 2006 in instant application 08/471,890, applicant states on page 28 that according to the Declaration of Raouf O. Loutfy (dated July 16, 2002 and filed in copending application 07/580,246), Dr. Loutfy states in

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paragraph 17 therein that 0.1 milligram or 100 micrograms is a macroscopic amount of fullerene that can still be seen with the naked eye.

Applicant's claims 92, 104, 105, 107, 109, 113, and 119 as written do not exclude or distinguish from the naturally occurring fullerenes in the coal deposits of Yunnan, China. Claims 92, 104, 105, 107, 109, 113, and 119 do not require isolated or purified fullerenes. The term "recovering" in claim 92 is not clearly defined in the specification and is interpreted to be broader than the terms extracting, separating, and isolating. A fullerene chemically produced that is recovered as a visible solid as recited in claim 92 reads on macroscopic amounts of fullerene in the solid phase.

With respect to claim 109, the limitation "after being dissolved in benzene and then evaporating off benzene" does not appear to be a positive limitation and the claim as written reads on macroscopic amounts of fullerene. With respect to claim 119, the claim as written does not require the fullerene (cage carbon allotrope of carbon consisting solely of carbon atoms that is soluble in non-polar organic solvents) to be a colored crystalline solid but only that the fullerene is present in macroscopic amounts.

Furthermore, there is no evidence in the record that establishes that applicant's C₆₀ and C₇₀ differ in form, quality or properties from naturally occurring C₆₀ and C₇₀.

The product-by-process limitation of claim 92 is not given patentable weight since the courts have held that patentability is based on a product itself, even if the prior art product is made by a different process (see In re Thorpe, 227 USPQ 964, (CAFC 1985), In re Brown, 173 USPQ 685 (CCPA 1972), and In re Marosi, 218 USPQ 289, 292-293 (CAFC 1983)). Thus,

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absent any evidence that the product of Applicant's process as claimed is different from naturally occurring C₆₀ and C₇₀, claim 92 is likewise seen as a claim that does not distinguish from the naturally occurring products.

Claim Rejections - 35 USC § 102

11. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claim Rejections - 35 USC § 103

12. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

13. Claims 92, 104, 105, 107, 109, 113, and 119 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Kappler et al. (J. Appl. Phys. 50 (1), 1979, pp. 308-316) as evidenced by Kratschmer et al. ("Search for the UV and IR Spectra of C₆₀ in Laboratory-Produced Carbon Dust," in Dusty Objects in the Universe (Netherlands, Kluwer Academic Publishers, 1990), E. Bussolletti and A.A. Vittone (eds.), pp. 89-93) and Smalley (US Patent No. 5,227,038).

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Kappler et al. discloses a method of producing carbon vapor by electrically heating graphite rods at 100-110 amps under an atmosphere of 30 torr of argon (p. 308, col. 2; p. 309, col. 1; p. 310, col.1 and col. 2). The graphite rods are 3 mm in diameter and 2 cm (20 mm) long (p. 308, col. 2). Carbon particles are deposited on the Pyrex wall of the evaporation apparatus at a distance of 4 cm from the vaporization source (p. 310, col. 1). Evaporation of the carbon is carried out by alternative periods of heating (2 min) and cooling (30 minutes) of the graphite rods (p. 309).

The method of Kappler et al. inherently produces carbon particles containing macroscopic amounts of C_{60} and C_{70} (two species representative of fullerenes) because the method of Kappler et al. is nearly identical to the method disclosed by applicant (see also declarations filed by applicant on September 2007) to produce macroscopic amounts of C_{60} and C_{70} . As disclosed by applicant in the instant specification, a pressure range of 50 torr to about 400 torr produces C_{60} and C_{70} (pages 4 and 6 of the instant specification).

While Kappler et al. discloses using 30 torr of argon instead of 50 torr of argon, Kratschmer et al. discloses that a lower argon pressure compared to helium pressure is needed to produce C_{60} . Kratschmer et al. discloses that 30 torr is the lower pressure limit for argon to produce detectable features of C_{60} in an infrared or ultraviolet spectrum of carbon smoke while 50 torr is the lower pressure limit for helium to produce detectable features of C_{60} in an infrared or ultraviolet spectrum of carbon smoke (pp. 91-92). Specifically, Kratschmer et al. discloses the following on pages 91-92:

“As far as the appearance of the features is concerned, we observed that a kind of transition pressure of the quenching gas exists above which the features appear regularly and below which they usually do not. For He, this pressure is about 50 torr and for Ar it seems to be smaller, i.e. about 30 torr.”

In addition to using an equivalent quenching pressure of the inert gas as applicant (applicant uses helium in the examples in the instant specification and Kappler et al. uses argon), Kappler et al. also uses the same electrical current (100 A) for evaporating the graphite rods and about the same collection distance (4 cm) from the vaporization source to collect the carbon particles (sooty carbon product) that inherently contain C_{60} and C_{70} . Applicant uses $\frac{1}{4}$ in. (6.35 mm) diameter rods that are 1 cm in length. The volume of a cylinder is $\pi r^2 h$. Although the volume of the rod used by Kappler et al. is about half that of applicant, macroscopic amounts of C_{60} and C_{70} would be inherently produced by the method disclosed by Kappler et al. since the lower limit that can be seen with the naked eye is 0.1 mg (see remarks filed by applicant on May 9, 2006 in instant application 08/471,890 where applicant states on page 28 that according to the Declaration of Raouf O. Loutfy (dated July 16, 2002 and filed in copending application 07/580,246), Dr. Loutfy states in paragraph 17 therein that 0.1 milligram or 100 micrograms is a macroscopic amount of fullerene that can still be seen with the naked eye). The method of Kappler et al. inherently produces more than 0.1 mg of C_{60}/C_{70} since applicant's method produces more than 0.2 mg of C_{60}/C_{70} according to the declarations filed by applicant on September 2007.

As further evidence that the method disclosed by Kappler et al. inherently produces C_{60} and C_{70} , Smalley et al. discloses that fullerene is formed at 10 to 500 amps at 10 to 50 volts (col. 4, lines 18-21) and the pressure needed ranges from 1 to 20,000 torr, preferably 5 to 2000 torr and preferably 50 to 500 torr of helium (col. 5, lines 3-8). As shown in Table 1 of the Smalley reference, lower pressures of argon are used compared to helium to generate fullerenes. At 25 torr of Ar, the amount of fullerene yield is 5.2 wt% of the soot (col. 10, lines 58-65).

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Instant claims 92, 104, 105, 107, 109, 113, and 119 do not require isolated, extracted, or purified fullerenes. The term "recovering" in claim 92 is not clearly defined in the specification and is interpreted to be broader than the terms extracting, separating, and isolating. A fullerene chemically produced that is recovered as a visible solid as recited in claim 92 reads on macroscopic amounts of fullerene in the solid phase.

With respect to claim 109, the limitation "after being dissolved in benzene and then evaporating off benzene" does not appear to be a positive limitation and the claim as written reads on macroscopic amounts of fullerene. With respect to claim 119, the claim as written does not require the fullerene (cage carbon allotrope of carbon consisting solely of carbon atoms that is soluble in non-polar organic solvents) to be a colored crystalline solid but only that the fullerene is present in macroscopic amounts.

The product-by-process limitation of claim 92 is not given patentable weight since the courts have held that patentability is based on a product itself, even if the prior art product is made by a different process (see In re Thorpe, 227 USPQ 964, (CAFC 1985), In re Brown, 173 USPQ 685 (CCPA 1972), and In re Marosi, 218 USPQ 289, 292-293 (CAFC 1983)).

It is noted that Dr. Harold Kroto in his declaration dated 9 June 1995 and filed on December 6, 1996 in instant application 08/471,890 addressed the Kappler et al. reference by stating that he did not believe that the method produced C₆₀. However, Dr. Kroto did not give any scientific explanation as to why C₆₀ or any fullerene would not inherently be produced by the

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method disclosed by Kappler et al. Therefore, absent factual evidence, Dr. Kroto's conclusory statement regarding the Kappler et al. reference is not persuasive.

It is noted that Smalley and Kratschmer et al. are cited as evidentiary references and not as prior art. See MPEP 2124 for exception to the rule that the critical reference date must precede the filing date.

14. Claims 92, 104, 105, 107, 109, 113, and 119 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over J. Lefevre, "Investigation of Iron and Carbon Dusts," Annales D'Astrophysique, Vol. 30, No. 4, pp. 731-738, 1967, as evidenced by Liu et al., "Experimental Results on High Yield C₇₀ Fullerene," Chin. Phys. Lett., Vol. 11, No. 10 (1994), pp. 609-610, Smalley (US Patent No. 5,227,038), and Rietmeijer et al. "C₆₀ and Giant Fullerenes in Soot Condensed in Vapors with Variable C/H₂ Ratio", Fullerenes, Nanotubes, and Carbon Nanostructures, Vol. 12, No. 3, pp. 659-680, 2004.

Lefevre discloses producing carbon dusts by having an electric arc discharge in argon (p. 2 of translation). The method of producing the carbon dusts comprised of using a stable electric arc between two carbon electrodes in a twenty-liter container (see pp. 2-3 of translation). The container is first evacuated and then filled with argon (an inert quenching gas) at atmospheric pressure (1 atmosphere) and then emptied and filled again with argon at atmospheric pressure (1 atmosphere), see pages 13-14 of translation. The electric arc vaporizes the carbon electrodes and then condensation takes place to form the carbon dusts (p. 14 of translation). The arc is stabilized by a 3 kW rheostat corresponding to an intensity of 15 A under a potential difference

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of 20 V (see p. 4 of translation). The dusts produced are collected for examination on standard electron microscope grids at varying distances from 10 to 15 cm from the arc (p. 3 of translation). Lefevre's disclosed method for producing carbon dusts inherently produces macroscopic amounts of C_{60} and C_{70} (two species representative of fullerenes) as evidenced by applicant's specification, Liu, Smalley and Rietmeijer et al. for reasons given below.

Applicant states on page 4 of the instant specification:

"In the production of C_{60} and C_{70} , any procedure for vaporizing carbon can be used, although the preferred method relies on the use of a high intensity electrical current with graphite rods as electrodes...The rods can be prepared using any of the various forms of carbon, such as graphite, amorphous and glassy carbon.

The inert quenching gas can be any of the usual inert gases such as the noble gas. Argon and helium are preferred, the latter being most preferred...The amount of C_{60} and C_{70} produced from this carbon source is dependent upon the pressure of the quenching gas. At lower pressures relatively pure C_{60} molecules can be produced in high yield with minor concentrations of C_{70} . For the production of predominantly C_{60} molecules, the pressure at which the quenching gas is maintained should be subatmospheric and preferably about 50-400 torr. Especially preferred is a pressure of approximately 100 torr. The use of any lower pressure may result in reduced yield of C_{60} .

However, as the pressure is raised, the ratio of C_{70} : C_{60} is also increased. If the pressure is increased to at least two atmospheres, the greatest percentage of C_{70} product is formed."

While applicant discloses the optimum range for producing C_{60} is less than 1 atmosphere, applicant discloses that if the pressure is increased to at least two atmospheres, C_{70} would be the dominant product but C_{60} would also be present. It is noted that Dr. Adam Darwish in his September 2007 Declaration filed in the instant application stated that macroscopic amounts of C_{60} and C_{70} were produced at 2 atmosphere of the inert gas pressure. Thus, at 1 atmosphere of

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argon used by Lefevre, it is expected that macroscopic amounts of C_{60} and C_{70} would be inherently present in the carbon soot produced by Lefevre.

Smalley et al. discloses that fullerene is formed at 10 to 500 amps at 10 to 50 volts (col. 4, lines 18-21) and the pressure needed ranges from 1 to 20,000 torr, preferably 5 to 2000 torr and preferably 50 to 500 torr of helium (col. 5, lines 3-8). As shown in Table 1 of the Smalley reference, lower pressures of argon are used compared to helium to generate fullerenes. Thus, Smalley provides evidence that C_{60} and C_{70} are formed when the electrical current is at 15 A and the pressure of the inert gas in the reactor is 1 atmosphere in the method disclosed by Lefevre.

Furthermore, Liu et al. discloses producing C_{60} and C_{70} using an electric arc discharge between two electrodes at an electric current of 35-45 A at an inert gas pressure of 158 torr (21000 Pa), see p. 609. Liu et al. discloses that their method produces a large amount of C_{70} for manufacturing optical devices and carrying out other research work (last paragraph on p. 610).

Rietmeijer et al. discloses producing carbon particles containing C_{60} using an electric arc discharge between two amorphous carbon electrodes at electrical current of 10 A (p. 661) and in an atmosphere of 7 torr (10 mbar) of argon (p. 661). In sample 1, the vaporization of the carbon was conducted in 100% argon without any hydrogen present and the collector surface was located 5 cm from the source (p. 662). C_{60} was found in sample 1, and C_{70} was not found in sample 1 (p. 670). The absence of C_{70} is most likely due to the low pressure of argon (7 torr).

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Therefore, as evidenced by Smalley, Liu et al., and Rietmeijer et al., C₆₀ and C₇₀ can be produced at a wide range of current values below 100 A and are expected to be produced at a current of 15 A in the method disclosed by Lefevre.

Instant claims 92, 104, 105, 107, 109, 113, and 119 do not require isolated, extracted, or purified fullerenes. The term "recovering" in claim 92 is not clearly defined in the specification and is interpreted to be broader than the terms extracting, separating, and isolating. A fullerene chemically produced that is recovered as a visible solid as recited in claim 92 reads on macroscopic amounts of fullerene in the solid phase.

With respect to claim 109, the limitation "after being dissolved in benzene and then evaporating off benzene" does not appear to be a positive limitation and the claim as written reads on macroscopic amounts of fullerene. With respect to claim 119, the claim as written does not require the fullerene (cage carbon allotrope of carbon consisting solely of carbon atoms that is soluble in non-polar organic solvents) to be a colored crystalline solid but only that the fullerene is present in macroscopic amounts.

The product-by-process limitation of claim 92 is not given patentable weight since the courts have held that patentability is based on a product itself, even if the prior art product is made by a different process (see In re Thorpe, 227 USPQ 964, (CAFC 1985), In re Brown, 173 USPQ 685 (CCPA 1972), and In re Marosi, 218 USPQ 289, 292-293 (CAFC 1983)).

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It is noted that Smalley, Liu et al. , and Rietmeijer et al. are cited as evidentiary references and not as prior art See MPEP 2124 for exception to the rule that the critical reference date must precede the filing date.

Allowable Subject Matter

15. Claims 89, 91, 120, and 121 are allowed.
16. Claims 95 and 96 are objected to as being dependent upon a rejected base claim (claim 92), but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.
17. Claim 100 is objected to as being dependent upon a rejected base claim (claim 98), but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.
18. The following is a statement of reasons for the indication of allowable subject matter:

With respect to claims 89, 95 and 96, the closet prior art of record (Fang et al., Osawa et al., Kappler et al., and Lefevre et al.) does not disclose, teach, or suggest macroscopic amounts of an isolated fullerene (claim 89), macroscopic amounts of an isolated fullerene that is substantially pure (claim 95), or macroscopic amounts of an isolated fullerene that is substantially pure and crystalline (claim 96).

With respect to claims 91, 95, and 96, the closest prior art of record (Fang et al., Osawa et al., Kappler et al., and Lefevre et al.), does not disclose, teach, or suggest macroscopic amounts

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of isolated fullerene as a solid product (claim 91), macroscopic amounts of isolated fullerene as a solid product that is substantially pure (claim 95), or macroscopic amounts of isolated fullerene as a solid product that is substantially pure and crystalline (claim 96).

With respect to claim 100, the closest prior art of record (Fang et al., Osawa et al., Kappler et al., and Lefevre et al.), does not disclose, teach or suggest a visible solid carbon product being substantially fullerene and purified.

With respect to claim 120, the closest prior art of record (Fang et al., Osawa et al., Kappler et al., and Lefevre et al.), does not disclose, teach or suggest substantially pure fullerenes in solid form.

With respect to claim 121, the closest prior art of record (Fang et al., Osawa et al., Kappler et al., and Lefevre et al.), does not disclose, teach or suggest substantially pure fullerene in crystalline form.

Neither Kappler et al. nor Lefevre et al. disclose, teach, or suggest separating, extracting, or isolating C₆₀ or C₇₀ to any degree from the sooty carbon product. The C₆₀ or C₇₀ found in the coal samples of Fang et al. and Osawa et al. are not found isolated, extracted, separated, or purified in nature.

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Conclusion

19. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Howard et al. (US 5273729 A) discloses synthesizing macroscopic amounts of fullerene using the flame method.

20. Any inquiry concerning this communication or earlier communications should be directed to examiner Carol Chaney whose telephone number is (571) 272-1284. The examiner can normally be reached on Monday through Friday from 9:30 AM to 6:00 PM.

The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

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/Carol Chaney/

Supervisory Patent Examiner, Art Unit 1794